

# Using web technologies in the process of development of students' critical thinking

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**Abstract.** The article deals with the issues of development of critical thinking of students by means of web technologies. It presents the analysis of different scientific approaches to the organization of critical thinking training of students. The authors state that among the means of the above mentioned critical thinking development scientists distinguish information and communication technologies, particularly web technologies, as having a significant didactic and critical thinking potential. The experience of using web resources to verify information and data in the process of students' critical thinking development is explained. The article gives examples of the using remote special course on the basis of web resources implementation into real learning process. The application of web resources provides an opportunity to intensify critical thinking motivation of students, involves them in solving the discussed problems, and develops critical thinking skills, the ability to independently create and develop new knowledge based on the information received. Comparison of the results of ascertaining and forming sections allows to ascertain the effectiveness of the proposed pedagogical condition for the development of students' critical thinking by means of web technologies and the effectiveness of the developed remote special course for developing students' critical thinking by means of modern web technologies.

**Keywords:** critical thinking, HEI students, web technologies

## 1. Introduction

The current period of development of high education is characterized by the process of informatization [17]. The process of informatization is much influence on all social spheres, because it is a social product, which provides scientific and technological progress. The priority of informatization in society is high educational branch, as it involves web technologies for the implementation of new teaching methods and approaches.

Modern scholars insist on transformation of the ways to develop competitive and competent personality on the background of critical thinking development (Cottrell [12], Davies [14], Ennis [16], Hitchcock [18], Oner and Gunal Aggul [27], Schafersman [36], Williams [43]). Prominent scholars believe that modern specialists should be very mobile immediately after graduation of the university, and have the skills to think creatively which is closely connected with their ability to think critically, to solve problems and non-standard professional issues creatively and productively. Nowadays the global trend is to widely use digital technologies that optimize and intensify the efficiency of both the educational process in general and the impact on the

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development of critical thinking in particular (Barab, MaKinster and Scheckler [5], Brookfield [8], Kogut and Metiu [22], Oner [26], Pylypenko [31], Savchenko, Shekhavtsova and Zaselskiy [33], Schafersman and Stafford [35], Yang and Wu [45], Zair-Bek, Belikov and Plekhanov [46]). The trend of pedagogical education with a focus on the use of web technologies in the process of professional training has made us to turn to the experience of their use in order to implement scientific achievements, taking into account our scientific ideas.

Alim, Umam and Rohim [1], Arofah, Purwanto and Tsurayya [3], Pant and Muddgal [29], Rumpagaporn and Darmawan [32], Tania, Jumadi and Astuti [38] emphasize the problem of using technologies in development of critical thinking of students, because the students more frequently lack necessary skills to think creatively, to develop mental competence for effective solution of social, scientific and practical problems. During their training, the following tasks are typically put forward: first, to acquire knowledge about the laws and the methods of logical and critical thinking; second, to master the hypothetical-deductive logic of thinking with the elements of criticality; third, to learn and understand logical procedures, such as explaining and predicting, proving and refuting, arguing, evaluating, and self-assessing. It should be noted that for the purpose of our research we have implemented Web technologies into the educational process to develop critical thinking in students and it proved its efficiency during the pandemic of 2019–2021.

## 2. Discussion

Different scholars, such as Hitchcock [18], Oner and Gunal Aggul [27], Williams [43] offer various approaches and views on the technology of developing critical thinking. Oner and Gunal Aggul [27] states, that educational institution should revise technologies that help to develop critical thinking, turning to modern trends and effective resources. To find such technologies, it must be taken into account that they should be planned for three stages. In our opinion, Yahodnikova [44] has suggested specific to the national system of professional training stages of critical thinking development, which are taken into account and adapted considering the specifics of our field of study. Thus, the researcher offers a three-level technology for the formation of critical thinking: the first stage is provocation; the second is awareness; the third is reflection [44]. In the first stage, the cognitive processes are updated, which imply skills such as the ability to rely on knowledge and experience; the second stage is awareness, that is, assimilation of content. The main task of the second stage is to support the students' interest in the first stage of information and to stimulate students to track the learning of students. It should be noted that it is at this stage that the student is directly acquainted with new information through listening to lectures, editing text, watching a movie, performing an experiment, etc. The main task of the teacher is to intensify the activities of students, to use such tools as analysis, synthesis and comparison. The last, third stage is reflection. At the last stage, students are thinking about new material, adapting new concepts in their own system of knowledge, that is, changing the already learned idea and restructuring the formed connections which help to create new information for students.

A similar method of critical thinking development has been suggested by Briushinkin and Markin [7]. The researchers also identified stages, or levels of critical thinking enjoyment in

students [7], highlighting:

- 1 level – the emergence of criticality (the subject notes that there are some mistakes in the image of the object of knowledge, but he is not able to understand and explain them);
- 2 level – ascertaining criticality (students find mistakes made in the object of cognition, but they do not seek to reveal the source of their occurrence);
- 3 level – corrective criticality (students do not only distinguish between parts, details of the object of cognition in interconnectedness, interdependence and detect mistakes made in them, but also they reveal the causes of their occurrence, and also indicate ways and means of their elimination).

Thus, the analysis of the scientific literature allows us to understand that the process of students' critical thinking development (with the help of web technologies) should take three stages. The first stage is a challenge (activates students' interest and motivation, stimulates to active individual or group work/problem solving). The second stage is comprehension (keeps interest in the given problem field by providing new data/information, etc.). The third one is reflection (stimulates to self-analysis, self-development and motivation for further self-development and self-improvement). It is recommended to implement the proposed stages of critical thinking development using various technological and methodological tools [8, 13, 15, 26, 27].

Summarizing the results of the analysis of this literature, we have noticed that the scholars propose certain possible techniques for developing students' critical thinking, such as:

- 1) self-analysis and self-assessment of their level of readiness for critical assimilation of material and analysis of the critical potential of the problem;
- 2) the combination of reproductive and partially search methods of teaching in the performance of educational tasks and different types of criticism (criticism-analogy, criticism-praise, criticism-concern, etc.);
- 3) search methods of teaching, which are used while performing creative works;
- 4) transformation of methods and techniques of critical analysis to new situations;
- 5) the application of mental competence in the performance of independent work (reviewing, solving critical situations, analysis of data from Internet sources, books, public speaking, etc.).

The methods for determining the level can be divided into three groups:

- a) a set of tools, techniques and techniques for assessing the mental competence of criticality of mind in applying to a wide range of problems, situations, values and attitudes to criticality;
- b) private methods and techniques for assessing critical thinking skills and abilities in certain situations, specific subject areas;
- c) evaluation of certain aspects of critical thinking, expressed in the form of specific skills to see and comprehend problems, to compare their own and others' evidence in solving the problem.

In our opinion, accumulated scientific experience, including the above-mentioned methods and technologies, should be taken into account in the process of choosing web technologies

intended to influence and develop high level of critical thinking in students. In our opinion, the essence of the leading pedagogical condition that contributes to the development of critical thinking, is to optimize the development of students' critical thinking through the use of modern web technologies.

There are certain types of the use of information and communication tools in the educational context, such as [41]:

- 1) *personal messaging: free correspondence* (the structure of telecommunication activities can exchange information freely between groups via e-mail); *global class* (emailing two or more classes); *electronic "meetings"* (synchronous, real communication between students and their "guest");
- 2) *role-playing games* (participants communicate with each other, playing a role);
- 3) *information support* (the construction of telecommunication projects on the basis of collection, processing and comparison of various types of information of interest);
- 4) *information exchange* (thematic exchange of information between students all over the world, who, together with teachers, collects folk games, jargon, utterances, jokes, proverbs, fairy tales, information on health protection, folklore material on local and national holidays, aphorisms, tourist information. During this activity, both creators and users of the information they exchange become the communication entities);
- 5) *joint data analysis* (comparative and numerical analysis of information collected in different places; preparation of reviews, analysis of results, reports on what has been found);
- 6) *joint problem solving* (can take place both on the principles of competition and in cooperation).

Following the logic of presentation of the material, we consistently reveal the key component of the pedagogical condition. First, let's turn to the definition of "web technology" and describe the main purpose of their use in the process of forming students' critical thinking.

It is stated in scientific literature that information technology is materialized on the basis of information infrastructure knowledge in the field of creation, accumulation, storage, processing, transmission and use of information data. Information technology is a set of methods, tools, techniques that provide the process of finding, collecting, storing, processing, submitting and transmitting information with the help of using computer hardware and communication [6]. There are some widespread modern information technologies such as technologies of information-analytical and decision support systems; web technologies; CASE-technologies of computer-aided design, etc.

The concept of "web technology" is interpreted as information technologies, the use of which enables the processing of web resources hosted in the web space of computer networks (local or global) [6].

Today, there are several modern web technologies that can be used by educators to solve a variety of educational challenges. One of these technologies is Web 2.0 technology, the second generation of Internet network services that has recently become the basis for the development of the Internet.

Web 2.0 technologies are a network context that contains user activity products. They allow to work with large amount of publications, share information, comment and annotate texts (blog, Wiki-wiki, LiveJournal) create presentations, slides, slideshows, videos, audio clips,

self-complete sites with specific content, exchange messages (RSS pages, wiki, chat, Skype, email, forums, messengers, and more), visualize the connections of online community members, interact, and collaborate [41, 42].

The use of Web 2.0 technologies is urgent at the present stage of development of the Internet and social networks are their prominent representatives. They have quickly become popular as they provide new opportunities for self-realization and free communication; moreover, social networks are a flexible tool for creating a learning and information environment that can be developed independently. Self-development and voluntary filling of social networking information with users are the basic foundations of Web 2.0 technology, which considers the communication of participants in the process of transmitting and receiving information, not as the developer and user (Web 1.0 technology), but the user as a co-developer, the reader as a co-author, the team of authors as a society [20, 21].

Web 2.0 is the most important component of the learning process, as the technology allows to realize new possibilities of the Internet space, in the context of which the emphasis is on socialization, getting closer to users, interaction of the curator and students, development of online services, simplifying the process of obtaining information and working with it.

Web 2.0 in learning, there are many benefits that make it worthwhile to tackle such challenges. Among these advantages are the following:

- *Permanence of evidence.* These tools allow students to create a sort of learning evidence portfolio. For example, the use of blogs as a periodical portfolio of learning reflections.
- *Communities' creation.* This sort of tools is conducive to community creation, as students go on identifying for example, through the profile or trough certain types of content, similar interests.
- *Multiple resources.* Such tools provide access to a variety of information resources: presentations, documents, videos, images, etc. These resources often provide some learning activities.
- *Massive and rapid scope.* Students often access them several times a day, which is not usually the case with traditional learning platforms (LMS) or with the use of email address use for academic affairs.
- *Creating and sharing knowledge.* These tools help to foster the desire to create and share their knowledge with peers. By using these tools all peers see what each student does is important, because in the process the students feel more involved in their own learning, while contributing to the generation of knowledge in the course and sharing it with their colleagues.
- *Playful environment.* For students, a tool such as YouTube or Facebook makes them feel in their own environment, or at least in a neutral space, and not in an institutional one, a place where besides connecting with colleagues and friends for any given social event, you can also find out about other official activities.

Web 2.0 technology is the technology of a new stage of evolution on the Web that was not implemented suddenly, replacing the websites; on the contrary, it was a result. The current version of the network refers to the so-called Web 3.0, which represents the Network as a stage of "reading performance record" [21, 34].

Web 2.0 technologies are called social services on the Internet, as their use is usually shared within an appropriate group of users. User groups can form entire online communities that work together to achieve that goal. An example of such a group could be the creation of an online community of students to share an educational web resource to generate students' critical thinking. Obviously, Web 2.0 technology can act as a means of using an educational web resource for students.

The simplicity and convenience of use of social services Web 2.0 allows to save time and not to waste it on long explanations of technology of functioning of web systems. Features of functioning of web technologies are: technical basis – local and global networks (e.g. Internet); the organization of web resources in the network is carried out using hypertext technology; web resources are viewed using a web browser; use of systems of search of web resources; unlimited number of users who can download and view web resources and more.

### **3. Methodology of research**

The implementation of a pedagogical condition for optimizing the formation of students' critical thinking through the use of modern web technologies was carried out in order to exercise purposeful tutoring of the above mentioned process and to optimize the process of forming students' critical thinking through the use of modern web technologies. This condition was aimed at developing students' critical thinking and providing students with advisory assistance in the process of raising students' awareness of searching, retrieving and critically analyzing certain information. In order to fulfill this condition, a special method on developing the critical thinking of students was implemented into the regular educational process which was carried out on the Moodle platform during two semesters (<http://do.luguniv.edu.ua/>).

The experiment has been conducted at Luhansk Taras Shevchenko National University and Volodymyr Dahl East Ukrainian National University. The experimental training has been provided in two stages: stage 1 – 2019-2020 academic year; stage 2 – 2020-2021 academic year. The participants of the experimental study are the students of the Faculty of Foreign Languages (Luhansk Taras Shevchenko National University) and the Faculty of Philology (Volodymyr Dahl East Ukrainian National University) majoring in the following specialities: 014.02 Secondary education. Language and literature (English); 014.02 Secondary education. Language and Literature (German); 014.02 Secondary education (Language and Literature (French)); 014.02 Secondary education (Language and Literature (Spanish)); 014.02 Secondary education (Language and Literature (Chinese)); the Educational and Scientific Institute of Physical Education and Sports (Luhansk Taras Shevchenko National University) majoring in the following specialities: 014 Secondary education (Physical culture); 017 Physical culture and sports (Sport); 227 Physical therapy, Occupational therapy. A total number of students which have taken part in the experimental training is 274 (consisting of 136 and 138 students in control and experimental groups respectively). It should be admitted that the proposed method, although it has been tested on the above-mentioned specialities, can be adapted and implemented in the educational process at any field of education.

While forming the experimental and control groups, we have considered the following: approximately the same number of students in the control and experimental groups; students

in both groups are approximately of the same age (17–19 years); the content and essence of the curricula are approximately the same in the control and experimental groups. Consequently, the students from control and experimental groups and 7 teachers from profession-oriented departments helped to conduct the experimental research.

A traditional “knowledge-based” approach has been applied to the students from control groups. The process of training was mostly focused on the traditional curriculum, the students attended lectures, made reports, completed various practical tasks and exercises. In the experimental groups, the emphasis in professional training was placed on the use of web technologies that encourage the students’ critical thinking development. That is, the method of work in experimental groups has been focused on the improvement and upgrading of the disciplines of the professional cycle via the method of developing critical thinking using web technologies. The list of the subjects, which content, in our opinion, should be upgraded and improved in order to meet the purpose of the given study, included “Practice of oral and written speech”, “Practical grammar”, “Practical phonetics”, “Linguistics”, the 4th year practical training, “Theoretical foundations of Paralympic and professional sports”, “Theory and methods of Olympic and professional sports”, “Coaching (practical training)”. The curricula in these subjects have not been changed, our influence has been directed only at the method of presenting information, and Web technologies have been actively used in the educational process aimed at developing critical thinking in students.

In the first stage of the project on creation of students’ critical thinking by means of web technologies a courses on Moodle platform were provided with information-cognitive web resources, which would help to develop students’ critical analysis skills and media literacy; secondly, it was necessary to engage and motivate students to participate in an experimental project for developing critical thinking; thirdly, it was necessary to develop criteria and indicators for experimental verification of the pedagogical condition for optimizing the formation of students’ critical thinking by means of using modern web technologies. In the second stage, the content of the special course was filled with web resources that were used in the experimental study. Web resources are presented below in order to select tasks for the development of critical thinking. That is, information for critical thinking development should be planned in such a way as to stimulate students’ interest in their chosen field of study, to motivate and stimulate them to active individual or group work to solve tasks related to practical or seminar courses. These Web resources provide an opportunity to comprehend the information obtained, identify its key problems and generate creative ideas to solve the tasks and objectives. The given web technologies provide an opportunity for reflection, which will undoubtedly stimulate students to self-analysis and motivation for further self-development and self-improvement.

*Web resources for verifying information and data to develop critical thinking:*

- BBC NEWS (<https://www.bbc.co.uk/news/>);
- TED Talks (<https://www.ted.com/talks/>);
- British Council (<https://www.britishcouncil.org/>);
- Goethe-Institut (<https://www.goethe.de/en/index.html>);
- French Institute Alliance Française (FIAF) (<https://fiaf.org/frenchclasses/>);
- Confucius Institute (<https://www.cief.org.cn/kzxy/>);
- PlanetWare (<https://www.planetware.com/>);

- Committee on Physical Education and Sports of the Ministry of Education and Science of Ukraine (<http://sportmon.org/>);
- International Olympic Committee (<https://olympics.com/en/>);
- Association of National Olympic Committees (<https://www.anocolympic.org/>);
- Serhiy Bubka's personal website (<http://www.sergeybubka.com/>);
- Website of the XXXII Olympic Games 2020 in Tokyo (<https://olympics.com/en/olympic-games/tokyo-2020>);
- Legal information (founders, signatories, date of registration, contact address and telephone number) (<https://usr.minjust.gov.ua/content/free-search>)
- How to find out about a website owner? A lot of information about digital security by Vitaliy Moroz (<https://techtoday.in.ua/tips>)

*Leading media organizations in social networks that can be used to develop critical thinking:*

- Learn English (<https://www.facebook.com/LearnEnglishwithABCAustralia>)
- English Grammar (<https://www.facebook.com/GrammarUpdates>)
- Learn English Online (<https://www.facebook.com/learnenglishonline2>)
- Ukrainian sport and Olympics (<https://www.facebook.com/summersportsukraine>)
- Ukrainian sport (<https://www.facebook.com/sportofukraine>)
- @learn\_english\_.speaking ([https://www.instagram.com/learn\\_english\\_.speaking](https://www.instagram.com/learn_english_.speaking))
- #learnlanguages (<https://www.instagram.com/explore/tags/learnlanguages/>)
- #СПОРТУКРАЇНА (<https://www.instagram.com/explore/tags/%D1%81%D0%BF%D0%BE%D1%80%D1%82%D1%83%D0%BA%D1%80%D0%B0%D1%97%D0%BD%D0%B0/>)
- Sport.ua ([https://twitter.com/sportua\\_news](https://twitter.com/sportua_news))
- LanguageLearningLib (<https://twitter.com/LangLearnLib>)
- Linguistic (<https://twitter.com/LinguisticApp>)
- NST Languages Trips (<https://twitter.com/NSTLanguages>)

*Critical information analysis projects, guides, and films:*

- Beyond the news (<https://www.facebook.com/behindtheukrainenews>)
- Media Literacy Lab (<https://www.facebook.com/groups/medialiteracylab>)
- Film English (<https://film-english.com>)
- Movies in English (<https://mubi.com/lists/movies-in-english>)
- Best movies to learn English with (<https://www.ef.com/wwen/blog/language/10-movies-to-learn-english-with/>)
- The Foundation for Critical Thinking (<https://www.criticalthinking.org/pages/critical-thinking-where-to-begin/796>)
- Corporate training materials (<https://corporatetrainingmaterials.com/products/Critical-Thinking>)
- 10 Great Critical Thinking Activities That Engage Your Students (<https://blog.futurefocusedlearning.net/10-great-critical-thinking-activities-that-engage-your-students>)



- Critical Thinking (<https://www.playmeo.com/theme/critical-thinking/>)
- 10 Fun Web Apps, Games, for Teaching Critical Thinking Skills (<https://www.emergingedtech.com/2016/06/10-technology-tools-resources-teach-critical-thinking-skills/>)
- Free Critical Thinking Games ([https://www.freethinkinggames.com/free\\_critical\\_thinking\\_games.html](https://www.freethinkinggames.com/free_critical_thinking_games.html))
- 81 Fresh & Fun Critical-Thinking Activities (<http://videa.ca/wp-content/uploads/2015/07/81-Fun-critical-Thinking-activities.pdf>)

Now we shall describe the process of implementing the method of using these Web resources for the development of critical thinking in students. Within the framework of the above-mentioned academic subjects, various thematic tasks have been planned.

The tasks include five compulsory blocks, specifically:

- 1) development of prognostic and analytical abilities;
- 2) activation of mental activity through knowledge application;
- 3) development of analytical skills and the ability to compare and contrast information;
- 4) development of system-analytical abilities and holistic perception of the text in the process of reading and studying information;
- 5) development of skills for solving problem situations.

Within the first block, we have proposed to introduce the following techniques and technologies that contributed to the development of prognostic and analytical abilities of students:

- *technique “Do you believe?”* is aimed at testing the validity of hypotheses, the development of abilities to predict and analyze concepts and involves processing textual information by finding answers to questions;
- *“Tree of Prediction” technique*, which helped the students to make assumptions about the development of the story line of the articles on various topics, which involves defining a topic in the form of a tree trunk, where branches mean assumptions and tree leaves symbolize their explanation;
- *“Logbook” technique* contributes to the development of students’ mental activity and involves generalization and comparison, which require to record students’ thoughts at the stage of challenge, and then to record textual information – at the stage of reflection.

In the context of the second block, the techniques to activate the mental activity of the participants of the experiment by applying their previously acquired knowledge have been introduced. The participants were asked to give answers to the following questions:

- *the technique is called “thick” and “thin” questions*. It activates mental activity while actively fixing questions in the process of obtaining or searching for information by means of reading, listening, reflecting. Here are some examples of such questions: “thick” questions: explain the facts or why? What’s the difference? What if...?; and “thin” questions: Who? What? When? What’s your name? It involves the work with textual information of the mass media relevant to the topic of the training

- *cluster technique* (SMART Strategy by Vaughan and Estes [40]) is used to select semantic units of the text or make a detailed plan to develop analytical skills of the participants, who graphically draw semantic units of text in a certain order in the form of a bunch;
- *insert* is a technique of developing critical thinking through reading and writing, which is used in the process of working with new textual information from mass media sources. It involves content analysis of the text, i.e. marking the text in the course of its reading, which requires updating the existing knowledge of students.

Within the third block, the students from experimental groups have been offered techniques that contributed to the development of analytical skills and the ability to compare and contrast information. We have implemented such techniques as:

- *Summary table*, which has been offered to the participants to compare three or more aspects of the problems: horizontally – what is to be compared, and vertically – the features and properties by which it should be compared.
- The *table-synthesis technique* is aimed at developing the analytical skills of the participants, which led to the completion of the table, which involves the synthesis of information at all stages of the given technique. It gives the participants an opportunity to closely connect the content of information with their personal experience.

Table-synthesis technique is based on Bloom's taxonomy of educational objectives [2]. This technique is aimed at developing such skills as designing, discussing, analyzing, and understanding textual information. It also develops system-analytical, prognostic abilities and holistic perception of the text.

The technique involves three stages:

- 1) challenge (the participants are offered to create an information text with the help of key words, then the participants discuss the headlines, predict the content and problem field);
- 2) comprehension (the participants read the text in excerpts and discuss at each stop what will happen next and why);
- 3) reflection (involves final consideration of the text as a whole).

When introducing this technique, the peculiarities of journalistic texts and possible ways of working with them should be taken into account, i.e. there should be a careful selection of the texts from the media.

Now we shall detail the Web 2.0 technologies that we have used to develop critical thinking in students from the experimental groups. First of all, it is recommended to include services to create a *Wiki*.

We have used the recommended materials offered by Brox [9], Medero and Albaladejo [25], Zinger, Tate and Warschauer [48]. According to the recommendations of the scholars, we suggest to use Wikis to annotate, visualize and detail information, comment on the information provided by the link, etc.; to create virtual excursions, creative works (fairy tales, poems, essays, articles, theses), thematic glossaries in cooperation with the students. To create wikis, we suggest using such resources as Blogger; Edublogs; WordPress, Wikispaces, PBWorks, MediaWiki, DokuWiki, Zoho and others.

The next resource is *blogging technology*, which allows to take notes while solving a task or a problem. To select a platform for communication, one can contact the following sites: JifeJournal, Blogger, WordPress, Twitter, FriendFeed. According to methodical recommendations of Arwani, Masrur and Khakim [4] while using blogs in the educational process, we have come to the conclusion that the proposed sites allow any user to join the discussion and solve problems or tasks; find like-minded people not only among the group mates but also on the World Wide Web; establish friendly and professional relations for further collaboration, etc.

The third resource is the capabilities of *social search engines* which can adjust individual and collective search to perform tasks, taking into account the subject and so on. Google.com features have become the most common among our students, but we can also recommend such resources as Swicki.com and Rollyo.com, which allow to put individual search criteria. The system quickly learns itself from the results of user search history and gives the results that are most relevant in the selected branch, etc. In addition, for effective teamwork during the search, we recommend using services for cooperative storage of bookmarks (Delicious, Symbaloo, Pocket, Instapeper, Evernote, Pinterest, etc.).

The fourth technology that must be involved in the development of critical thinking is *geographic services (maps)*. Students who have been involved in the experimental study were asked to use Google Maps to solve problems to find special places using GPS coordinates. Such tasks provided an opportunity to broaden their horizons, develop search skills and learn historical facts and events; to carry out literary and cultural walks. In addition to the usual geolocation maps, Mind Maps features are already quite common, and we always use them to develop critical thinking in students. According to the recommendations of Buzan [10, p. 159] the use of maps makes it possible to create charts, diagrams, visually present ideas, problems, theses. All these can be unified with any idea with the help of graphic arrows. It makes possible to store a large amount of information in memory, to find connections between individual parts, to be able to reproduce information even later. During the experimental study, we have used the opportunities of Mindmaps, Coggle, XMind, FreeMind, Bubblus, MindMeister, Mindomo, Simple mind viewer, etc.

A separate, fifth source, is *virtual boards* (Padlet, Stormboard, Trello, Mirro, etc.). According to modern research, they offer a wide range of educational opportunities [11], among which we have identified the ability to encourage team activities in thematic fields; update previously received information; conduct brainstorming; cooperative collection of arguments/material/information; compile a compatible synopsis; give consultations; test students' knowledge; store information; write reports.

The sixth source is the services and resources for creating *interactive textbooks and interactive presentations* (Canva, Kotobee, Venngage, Designrr, OurBoox, Twinkl, etc).

Such technology makes it possible to intensify the educational process, making it more interactive and multimedia, paying attention to the individual capabilities of students and their educational goals.

Finally, we shall list Web 2.0 resources that allow to create various kinds of interactive tasks to develop critical thinking in students. For such purposes, the most convenient for teachers involved in the study are the following: LearningApps, Google Forms, Wardwall, Insertlearning, Nearpod, Peergrade, Kahoot, Flippity, Smart Builder, Classtools, etc.

The participants of the control and experimental groups during the pedagogical experiment

were students of two leading universities of Ukraine (Luhansk Taras Shevchenko National University and Volodymyr Dahl East Ukrainian National University). At the beginning of the experimental study the students from both groups have been tested and showed approximately the same level of critical thinking development in both groups.

To test this we have developed the criteria and indicators of students' critical thinking:

- 1) *motivational* (motivation to search, retrieve and critically analyze certain information; constant motivations to achieve success, self-fulfillment in professional activity);
- 2) *content-related* (basic knowledge about information resources, information systems, information technologies, informatization of society; the ability to independently create and develop new knowledge based on the information received);
- 3) *activity-based* (the ability to operate following the sequence of actions and complete awareness of the actions for critical analysis of new information; information insight, the ability to plan and predict possible consequences based on the information received);
- 4) *resultative* (self-assessment and self-reflection concerning the critical analysis of the information received; the ability to predict the result through critical thinking due to the information received).

According to the logic of our scientific research, we should describe in detail each level of critical thinking development, which has been developed with the help of Web technologies.

At *high level*, students are skillful in processing and working with information, show a high level of knowledge and skills in working with information sources, using information and communication technologies, which they not only know how to use in educational and professional activities, but also are able to apply creatively and independently to create and develop new knowledge, ideas, etc. on the basis of the received information. At this level of critical thinking, students show practical ability to information insight, the ability to plan and anticipate possible consequences based on the information received, as they demonstrate the ability to make all operations in compliance with their sequence and are able to critically analyze new information.

A *sufficient level* of critical thinking is characterized by a strong motivation to a positive attitude to the system of professional values, views, interests and decisions in vital areas of social activity of students; conscious need for self-development and self-improvement; the desire to understand their own potential as prospective specialists in their field. This level is characterized by a sufficient level of skills for self-analysis; the received information is competently specified; the students are able to predict the end result due to the information obtained on the background of self-analysis; demonstrate values-based attitude to the information obtained through behavior and activities.

The *intermediate level* is basic in the development of creative thinking of students, which is characterized by indirect motivation for success, self-realization in professional and social activities. At this level, students demonstrate the lack of value orientations for self-realization and self-improvement; passive attitude to self-education and self-development. At this level students demonstrate the lack of skills and abilities to use educational resources, information systems, information technology in professional and educational activities, when they create innovative ideas through critical thinking. That is, critical thinking of these students is not sufficiently developed to form new knowledge on the background of the information obtained.

At the intermediate level, students are able to use information and educational resources and information technology to search for and obtain new information, but they are not able to generate new knowledge based on the information obtained.

At the *critical level*, students have basic theoretical knowledge about how to obtain information, but they are not able to adequately analyze the results of their own activities, compare it and independently adjust the strategy of rethinking and processing the information to develop their own opinions on various professional and educational problems. Therefore, students with a critical level of critical thinking development process the received information according to a sample or according to a certain plan or template. Instead, the analysis of any information requires an individual approach to its rethinking and reflection.

At the *low level* of critical thinking development students demonstrate both low motivation to study in general and to develop critical thinking in particular; lack of understanding of the value of their active position; they are not eager for self-development and self-improvement, for understanding their potential; they lack skills of critical analysis of the information; lack strong motivation for success, self-realization in professional and social activities. Such students completely lack the ability to independently create and develop new knowledge based on the information obtained. At this level students do not demonstrate the skills of critical thinking. In addition, such students are characterized by a lack of active position, mobility, adaptability in interaction; low ability to predict and to critical analysis of the received information; inability to resist information and psychological influence. Such students do not have the skills of information insight and the ability to plan and predict possible consequences based on the information obtained.

A number of traditional methods have been used as diagnostic tools for determining the level of critical thinking development in students. To assess the *motivational criterion* we have applied “The scale for assessing the need to achieve” [30]; *content-related criterion* was assessed by “The methods for assessing logical thinking” [24] and the methods of “Comparison of concepts” [23]; *activity-based criterion* was diagnosed using the adapted “Diagnostics of the structure of signaling systems: verbalization, abstraction” by Zeer, Pavlova and Sadovnikova [47, p. 138–144] and the adapted method of “Language Labyrinths” [39]. To assess the *resultative criterion* an adapted questionnaire “Psychological factors of business efficiency” has been used [19].

According to the results of the formative stage of the experiment for determining students’ level of critical thinking by the means of using modern web technologies by the motivational criterion, we have the following data, which are shown in the table 1.

Following the dynamics of the level of formation of students’ critical thinking on the motivational criterion at the beginning and at the end of the experiment, we noted significant positive changes in the formation of critical thinking by the mentioned criterion in the experimental group.

Thus, most of the students from the experimental group at the beginning of the experiment had average and sufficient levels, which were 31.1% and 29.6%, respectively. Instead, at the end of the experiment, we recorded the best data at the average level of 28.8% in the control group, and the sufficient level of the experimental group increased to 40.9% by reducing the average level of only 11.3%.

The dynamics of levels of formation of students’ critical thinking by the content-related criterion after the experimental work were distributed as follows, which is reflected in the

**Table 1**

Dynamics of levels of formation of students' critical thinking by the motivational criterion at the beginning and at the end of the experiment.

Criterion	Motivational			
	At the beginning of the experiment		At the end of the experiment	
	control group (%)	experimental group (%)	control group (%)	experimental group (%)
High	20.4	17.4	22.7	34.1
Sufficient	25.9	29.6	25.7	40.9
Average	29.5	31.1	28.8	11.3
Critical	13.6	12.1	10.6	7.6
Low	13.6	9.8	12.2	6.1

**Table 2**

Dynamics of levels of formation of students' critical thinking by the content-related criterion at the beginning and at the end of the experiment.

Criterion	Content-related			
	At the beginning of the experiment		At the end of the experiment	
	control group (%)	experimental group (%)	control group (%)	experimental group (%)
High	3.0	3.8	6.1	15.2
Sufficient	8.3	7.6	11.4	21.2
Average	25.0	27.3	32.6	31.0
Critical	28.9	28.0	24.2	14.4
Low	34.8	33.3	25.7	18.2

table 2.

The data obtained indicate that students had a rather low level of critical thinking formation by the content-related criterion at the beginning of the experimental work, which was only 3.8% in the experimental group and 3.0% in the control group. It should be noted that after the experiment, the level of critical thinking by the content-related criterion improved significantly and is 15.2% in the experimental group, and in the control group the indicator is only 6.1%.

Thus, at the beginning of the experiment, most of the students had a low level of critical thinking by the content-related criterion, namely: 33.3%, after all at the end of the experiment the low level of students was only 18.2%. According to the results of experimental work, we must determine the positive dynamics of the formation of critical thinking by the content-related criterion.

The level and dynamics of critical thinking by the activity-based criterion after experiment in the experimental group is shown in the table 3.

The experimental data obtained indicate that the level of students' critical thinking formation by the activity-based criterion at the beginning and at the end of the forming experiment in the experimental group has positive changes.

Thus, if at the beginning of the experiment the experimental group had a high level of 6.1%, then after the experiment it was 18.2%, that is, the high level of critical thinking by the activity-

**Table 3**

Dynamics of levels of formation of students' critical thinking by the activity-based criterion at the beginning and at the end of the experiment.

Criterion	Activity-based			
	At the beginning of the experiment		At the end of the experiment	
	control group (%)	experimental group (%)	control group (%)	experimental group (%)
High	4.6	6.1	6.1	18.2
Sufficient	13.6	12.8	15.9	28.0
Average	28.8	27.3	33.3	31.1
Critical	34.8	28.8	28.8	10.6
Low	18.2	25.0	15.9	12.1

**Table 4**

Dynamics of levels of formation of students' critical thinking by the resultative criterion at the beginning and at the end of the experiment.

Criterion	Resultative			
	At the beginning of the experiment		At the end of the experiment	
	control group (%)	experimental group (%)	control group (%)	experimental group (%)
High	6.8	9.1	14.4	20.5
Sufficient	11.4	12.1	19.7	24.2
Average	27.3	28.8	29.5	33.3
Critical	33.3	30.3	21.2	15.9
Low	21.2	19.7	15.2	6.1

based criterion increased three times, whereas in the experimental group the level almost did not change and is 6.1%. It should be noted that all indicators in the experimental group have changed in the positive direction, for example, the sufficient level at the end of the experiment was 28.0% while at the beginning it was only 12.8%.

The level of formation of critical thinking by the resultative criterion we were determined in the course of experimental work is defined in the table 4.

If, at the beginning of the experiment, the high level of critical thinking by the resultative criterion in the experimental group was only 9.1%, then at the end of the experiment the indicator changed significantly and is 20.5%.

The data obtained indicate that students not only revealed self-assessment and self-reflection concerning the critical analysis of the information received, but the ability to predict the result through critical thinking due to the information received.

With regard to the control group, during the period of the experimental testing the high level of critical thinking according to the effective criterion has hardly improved – 14.4%. At the end of the formative experiment, low scores in the EG are only 6.1% of students who are not able to critically analyze the phenomena occurring in the context of the information-hybrid war, to give their own assessment of events and so on.

#### 4. The results of the research

Based on the data obtained during the experimental work, it should be noted that the use of modern web technologies promotes the development of students to critically perceive information, as well as emotional stability and the ability to make the right decision, while abandoning the previous goal, namely, make a critical decision without hesitation.

We used Pearson's statistical criterion  $\chi^2$  to compare the levels of critical thinking of students in the control and experimental groups [28, 37].

Pearson's criterion  $\chi^2$  allows us to correlate two empirical distributions and to determine whether they agree. The reconciliation criterion is based on the use of different degrees of distance between the empirical distribution we are analyzing and the feature distribution feature in the population.

The results of the calculations given in the tables (table 5) indicate a statistically insignificant difference between the control and the experimental group at the beginning of the experiment by all criteria of formation of critical thinking: motivational, content-related, activity-based and resultative (the empirical value of the Pearson's criterion is accordingly; 1.6520; 0.347; 2.551; 0.799, which is not exceeding the critical value).

**Table 5**

Comparison of levels of students' critical thinking at the experimental and control groups according to Pearson's criterion  $\chi^2$ .

Criterion of students' critical thinking	The empirical value of the Pearson's criterion $\chi^2$		
	Experimental and control groups at the beginning of the experiment	Experimental group at the beginning and at the end of the experiment	Control group at the beginning and at the end of the experiment
Motivational	1.652	24.184	0.289
Content-related	0.347	29.519	5.579
Activity-based	2.551	32.707	1.917
Resultative	0.779	26.989	11.532

The critical criterion value is 9.49 for the four degrees of freedom and the 0.05 significance level.

Thus, based on the above data, we confirm that the selected groups – control and experimental, at the beginning of the forming experiment had almost the same level of critical thinking, and had almost the same knowledge and skills by all criteria: motivational, content-related, activity-based and resultative.

After the experimental phase, on the contrary, a statistically significant difference between the experimental group values at the beginning and the end of the experiment can be observed. The empirical value of the Pearson's criterion, respectively, for the level of formation for the level of motivation criterion – 24.184; for content-related criterion – 29.519; activity-based – 32.707; resultative – 26.989, which is much higher than the critical value of the criterion 9.49.

The data obtained allow us to conclude on the statistical significance of the experiment and the difference between the control and experimental groups by all criteria, which confirm the value of our experimental research work.



As for the control group, we observe a statistically insignificant difference between the indicators at the beginning and at the end of the experiment the empirical value of the Person's criterion for the activity-based criterion – 1.917; for content-related criterion – 5.579; for motivational respectively – 0.289, which does not exceed the critical value of the criterion. As for the resultative, the empirical value of the criterion is 11.532, which is slightly higher than the critical value of the criterion 9.49.

Thus, the control group also experienced some changes, but they are statistically insignificant except for the resultative criterion. It should be noted that positive changes cannot happen, because both the control group and the experimental group of students in the process of studying in the institutions of higher education are forming the critical thinking. The results of formation of critical thinking as a whole are significant for our study.

During the experimental work, oral and written surveys were used, questionnaires, which showed that the students of the experimental group had a higher level of critical thinking by the motivational criterion than the control groups, with the experimental group having a high level of critical thinking by the activity-based, content-related and motivational criterion.

The results of the test suggest that the pedagogical condition that has been offered has a positive effect on the process of forming students' critical thinking.

## **5. Conclusion**

Theoretical analysis of different points of view on the problem of technology of formation of critical thinking has made it possible to conclude that scientists do not have a single point of view regarding the universal technology of formation of critical thinking. Summarizing the scientific experience on the essence of this concept, it was concluded that technology of critical thinking contains: self-analysis and self-assessment of the level of their own readiness for critical assimilation of material and analysis of the critical potential of the problem; basic knowledge about information resources, information systems, information technologies, informatization of society; the ability to independently create and develop new knowledge based on the information received; methods and techniques for assessing the ability to think critically in specific situations, specific subject areas; evaluation of certain aspects of critical thinking, expressed in the form of specific skills to see and comprehend problems, compare their own and others' evidence in solving the problem.

The study identified the concept of “web technology” as information technology that allows the processing of web resources hosted in the web space of computer local or global networks.

We have developed the criteria and indicators of students' critical thinking: 1) motivational (motivation to search, retrieve and critically analyze certain information; constant motivations to achieve success, self-fulfillment in professional activity); 2) content-related (basic knowledge about information resources, information systems, information technologies, informatization of society; the ability to independently create and develop new knowledge based on the information received); 3) activity-based (the ability to operate following the sequence of actions and complete awareness of the actions for critical analysis of new information; information insight, the ability to plan and predict possible consequences based on the information received); 4) resultative (self-assessment and self-reflection concerning the critical analysis of the information received);

the ability to predict the result through critical thinking due to the information received). These criteria provide an opportunity to determine the level of socio-cultural competence for future foreign language teachers (high, sufficient, average, critical, low).

The results of the experimental study indicate the positive dynamics of the formation of critical thinking for the students of the experimental group compared to students of the control group. Comparison of the results of ascertaining and forming sections allow concluding on the effectiveness of the proposed pedagogical condition for the formation of students' critical thinking by the means of web technologies and the effectiveness of the developed remote special course for forming students' critical thinking by the means of using modern web technologies.

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